DOCUMENT RESUME

ED 174 393 SE 026 319

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TITLE A Student Guide to Studying General Chemistry.
PUB DATE Dec 78
NOTE 15p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Chemistry; *College Freshmen; College Science; Group Instruction; Higher Education; *Learning Activities; Science Courses; Science Education; *Science Instruction; *Student Responsibility

ABSTRACT

This is a guide for introductory college chemistry students who are new to the subject of chemistry and who have been exposed to linear and second-order algebra equations and the concept of slope. The guide presents directions on the following topics: (1) How to prepare for lectures and take notes; (2) How to study chemistry outside of class using the text and problem solving; (3) Preparing for examinations and using the examination as a learning tool; (4) How to prepare for a laboratory; and (5) What to do during the laboratory. A diagram of the basic chemistry learning scheme is given to illustrate the logical progression through the chemistry course. (SA)

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A STUDENT GUIDE TO STUDYING GENERAL CHEMISTRY

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December 1978

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INTRODUCTION

An Introduction to College Chemistry (CH-1) is perhaps your first experience with chemistry or it may be a continuation of a study which began in high school. Whatever the case you should find this study interesting and intellectually demanding. However, it should not be frightening.

Many students who did study chemistry prior to coming to college perhaps remember many times when the subject seemed overwhelming. This need not be the case here. This guide was written in an attempt to provide students with a group of logical steps that would allow them to proceed through their study of the subject without becoming lost early on in the course. No one need be overwhelmed by CH-1.

The first step in the study is to read this guide carefully. Secondly, students should refer to the guide from time-to-time as they proceed through their study of general chemistry.

PREREQUISITES

Assumptions have not been made about the students' chemistry backgrounds. From a student's perspective this means the course will proceed as if this were his first chemistry study. However, certain assumptions have been made concerning mathematics backgrounds. It has been assumed that (1) when necessary, students will be able to solve linear and second-order algebraic equations, (2) students understand the concept or meaning of the slope of a line segment tangent to a point on a curve, and (3) students understand the concept of one.

Probably the element most critical to smooth progress through CH-1 is an understanding of the numeral "one". If you will recall from your early studies in mathematics, one can be written in many forms:

$$\frac{1}{1}, \frac{2}{2}, \frac{3}{3}, \frac{4}{4}, \frac{5}{5}, \frac{A}{A}, \frac{B}{B}, \frac{AB}{AB}$$

are all forms of the numeral 1. By definition, then, one is any number that when written in its a/b form (for example 2/2) has a denominator that is contained in the numerator exactly one time.

Today, as in the past, the numeral 1 is used extensively in solving chemical problems. However, today the process is not called the use of one but dimensional analysis. The title – Dimensional Analysis – has crept into the subject because dimensions are included with the various numerals. In this regard,

$$\frac{1\text{m}}{1.194\text{ yd.}}, \frac{1.194\text{ yd.}}{1\text{m}}, \frac{1\text{cm}^3}{1\text{ml}},$$

$$\frac{2.54\text{cm}}{1\text{ in.}}, \frac{1\text{ml}}{1760\text{ yd.}}$$

are all different forms of one.

TEXTS AND MANUALS

Two texts and one manual are used during the conduct of CH-1. They are:

1. Brown, T. H., and LeMay, H. E. Chemistry: The Central Science. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1977.
2. Hill, J. C. Student's Guide to Brown and LeMay Chemistry: The Central Science. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1977.
3. Nelson, F. H., and Kemp, K. C. Laboratory Experiments For Brown and LeMay Chemistry: The Central Science. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1977.

PREPARATION FOR LECTURES

How students prepare for lectures may well determine not only how much their competencies increase in the subject matter area as a result of taking the course, but also what their final grades will be. While it is realized that the most important feature of any study is the extent to which the studier's competencies increase and not necessarily his final grade, our society still tends to place more weight on final grades than competencies. Therefore, students must constantly seek methods which will accomplish both. In truth, the maximum possible grades will in the future aid college graduates in finding the employment they desire. On the other hand, the ability to demonstrate a high degree of competency after the employment has been secured will allow one to hold that employment.

Adequate preparation for classes may well control both the student's final grade and competency level. Appendix A of this guide contains a course schedule. Reference to that schedule allows students to determine exactly where in their study they should be at any given moment. According to the lecture schedule it may be assumed that the first class meeting each week will deal with approximately 50% of the week's lecture material. Prior to attending a lecture students should read the textual material to be covered in the lecture. The old rule of thumb is that the student spends approximately one hour preparing for each one hour lecture. If you do this, you should find your lectures clear and continuous.

CONDUCT DURING LECTURES

The student's task while lectures are in progress is to take clear and concise notes. In this regard, it is not necessary to write down every word the lecture instructor says. Students will find they are better served at some later time by a good outline of the lecture material. If a standard outline format is used for

note taking such as:

I.
A.
1.
a.
(1)

the gaps and details may easily be filled in at some later time. Remember, listening is also an essential part of lecture participation. If all of your time is spent attempting to record each of the lecture's minute details you will probably miss hearing some important point.

STUDY FOLLOWING LECTURES

It is necessary soon after a lecture to unite the prelecture study and the lecture outline. If you have done your work well, this should not take more than, perhaps, an hour, and the final product should be a highly detailed and coherent outline of the subject at hand.

Once the prelecture study and the lecture have been dovetailed it is wise to solve problems exemplifying the important portions of the subject. Each chapter in the student's text has problems included specifically for this purpose. Notice that some problems are numbered in blue color while others are numbered in black. Those problems numbered in blue have their answers included in Appendix F at the back of the text.

Next, the student must decide whether or not he really understands the material. The answer to this question may manifest itself in your facility with end-of-chapter questions numbered in black. Students should solve these problems and check their solutions with their recitation instructor. If difficulty is experienced at this point discuss the matter with your recitation, lecture or laboratory instructor and then return to the text and your notes for additional study. In addition, it is important to note that other authors may present the material in a different manner. Perhaps a point may be clarified by consulting one of the many chemistry texts held by the Maine Maritime Academy library.

Two or three hours of well-spent study for each hour of lecture will generally result in high course grades and a high degree of competency with the subject material.

USING THE CLASS TEXT

Every text contains a wealth of information. If students are aware of this they will be better able to assimulate the course concepts.

Whenever a new course commences students should read their entire text at the very beginning. This is usually accomplished in several short steps, each of which do not require a disproportionate amount of time. First, the table of contents and various chapter subtitles are read. This gives the reader an idea of what subjects might be studied and how those subjects have been subdivided by the author.

The second step of the reading process requires thumbing through the text. In this phase it is necessary to notice major chapter subheadings; how those subheadings have been subsequently subdivided; figures and diagrams; and, finally, what is included in the various Appendices and on the inside of each text cover. In the case of the CH-1 chemistry text a periodic table has been printed on the inside of the front cover and the back cover contains basic SI units, derived SI units and SI unit conversion factors.

When the reader has obtained an overview of the text an individual chapter should be dissected. Perhaps the most important section to look at first is at the end of the chapter. Here, in the section titled "For Review", one finds a summary or an overview of material presented in the chapter. Also, in the review section is a list of learning goals for the chapter. The learning goals provide an item-by-item description of the competencies students should be able to demonstrate as a result of studying the chapter. These goals provide an advanced organization of the chapter. Later, after having read the chapter, students may test their competencies as they relate to these goals by working through the problems in the exercise section of the chapter.

In the review section, also, is a subsection titled, "Key Terms". The key terms presented in this section are highlighted in blue and then defined. As a result of studying the chapter, students should be able to define these terms.

Returning to the beginning of a chapter, notice that it is divided into subsections and each subsection heading reflects the concept being discussed in that subsection. Now, thumb through the chapter. In many cases key concepts presented in the context have been supported by figures, graphs, tables, pictures, and sample exercises. These aids are extremely important portions of each chapter for they present information which should allow the reader to visualize the concept under discussion.

The actual reading of each chapter should be done in two phases. As you know, each section begins with a topic paragraph. The first step should be to proceed through a chapter, reading only the topic paragraphs. Once Step #1 has been completed, the reader should return to the beginning of the chapter and read all of

the context.

USING THE STUDENT'S GUIDE TO THE TEXT

For each chapter in the text there is a companion chapter in the student's guide. As Professor Hill points out in his introduction to the guide, the guide was written specifically to aid students in understanding the material presented by Brown and LeMay in the student text. Each chapter of the student guide presents an overview of its companion Brown and LeMay chapter, topic summaries and exercises, key terms, and a self-study quiz. Notice that each of the sample exercises has a solution immediately following it.

Professor Hill suggests that students read the chapter in the study guide prior to reading the chapter in Brown and LeMay, Chemistry, The Central Science.

The study guide also contains Appendices extremely important to the study of general chemistry. Don't inadvertently pass them by.

USING RECITATION PERIODS

The recitation periods have been provided in order that students may obtain help solving problems. While they are to be attended on a voluntary basis, specific periods have been set aside each week when the recitation instructor will be available. During these sessions the instructor will solve problems from the chapter being covered that week. These problems, in as much as is possible, will be solved in a step-wise manner.

PREPARATION FOR LECTURE (HOUR) EXAMINATIONS

Preparation for a lecture examination should be a short process requiring perhaps not more than an hour. In this study, students should briefly review their lecture notes, the learning goals sections of the chapters to be covered on the examination, the chapters in Professor Hill's study guide, and perhaps the laboratory activities which have been conducted since the last examination.

The basic purpose of the examination is to test the student's facility (competency level) with the course material. This is accomplished by testing the student's ability to meet the learning goals of the various chapters. If you have followed some rational study scheme (such as the one presented herein) you should be able to demonstrate a high degree of competency on the examination.

STUDY FOLLOWING EXAMINATION

Examinations may be used by students as a learning tool. After an examination

has been returned, students should locate correct responses to items for which incorrect responses were provided on the examination. This allows for the correction of misconceptions which the student might have about the subject material. In addition, since most conceptualization is built upon previous background, correcting examination items provides students with a sound footing upon which to build their future study of the subject.

PREPARATION FOR LABORATORY SESSIONS

Prior to attending a laboratory session the laboratory activity for the week should be read in detail. If there are portions of the activity that are not understood, refer to relevant sections of your student text and text study guide before coming to the laboratory session.

CONDUCT DURING LABORATORY SESSIONS

Laboratory sessions are essentially for the purpose of data gathering, data manipulation, and technique development.

As students work through a laboratory exercise (each activity is conducted with a partner) they should discuss their observations amongst themselves. This scheme will facilitate understanding of the concepts with which the laboratory activity is concerned.

Completion of the laboratory sheets at the end of the various laboratory activities is the logical conclusion of work upon the activities. Completion of these sheets should help in obtaining a better picture of how the activity is tied to the greater subject of general chemistry.

PREPARATION FOR LABORATORY EXAMINATIONS

The laboratory examinations have been designed to test student competencies with subjects investigated during the laboratory activities and laboratory techniques learned during the conduct of the activities. In preparation for these examinations (there are two) students should review old lab reports, paying particular attention to the results and the techniques used in obtaining the results.

PREPARATION FOR THE FINAL EXAMINATION

Since the final examination is the culmination of the course it can be expected to cover the entire course; therefore, it is necessary to do a complete and thorough review prior to this examination. As with previous examinations, the learning goals sections of each of the chapters should be reviewed, only this time

the review should include all text chapters covered in the course. In addition, since laboratory activities support textual material, their results should be reviewed.

Although there is no acid test which will allow the student to predict his or her outcome on the final examination, it is well to consider the purpose of the final. Recall that the purposes of the three hour examinations were to evaluate student competency levels over a certain block of material. Further, the competencies students were to develop as a result of studying a specific block of material were identified as learning goals in the back of each text chapter. From this it might be inferred that the task of the final examination reevaluate students' facility or compentencies with all of the course material. To some extent this inference is correct; however, for a moment consider the implications of learning curves to final examinations (see Figure 1).

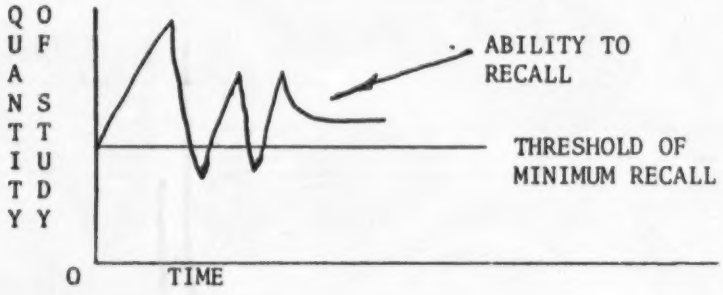

FIGURE 1. GENERAL LEARNING CURVE

The primary mission of a student's chemistry study is to gain knowledge and understanding of the subject which can be applied to real world situations. If it is impossible to recall (properly index the brain) the information when it is needed, then the study has been a waste of time. In this regard, consider Figure 1. As study is begun at time zero an individual's ability increases to some point above the threshold of minimum recall. Once study ceases, ability to recall drops and, if the initial quantity of study has not been sufficient, the ability to recall eventually falls below the minimum threshold level. This first peak might be analogous to the initial study of a text chapter. When study is resumed the minimum threshold is again crossed and recall is more or less immediate but, again, as the time after study increases the ability to recall decreases, but this time the curve does not proceed as far below the minimum recall level. The second peak might be related to an hour examination. Study again begins, perhaps this time for a final examination; however, this time notice that as time after study

increases the ability to recall does not fall below the threshold of minimum recall. Idealistically then, in the end, the student will always be able to call upon chemical expertise when it is needed. However, when you attempt to apply this curve to your own situation you should proceed cautiously. The learning curve is a generalized one, yet each of us is an individual, therefore, one person may require more study sessions than another before his ability to recall remains above the minimum threshold level. Hopefully, you will have reached that point by final examination day.

Final examinations, like hour examinations, are not only tests of student competencies but also learning tools.

AN OVERVIEW OF THE CHEMISTRY LEARNING SCHEME

The learning scheme presented in these pages was developed specifically as a facilitator of chemistry learning. It is intended to provide students with a guide to logical progression through a three-hour chemistry course which meets twice each week for lecture, where students have one two-hour laboratory session each week and where students attend recitation sessions on a voluntary basis. Figure 2 provides a block diagram of this scheme.

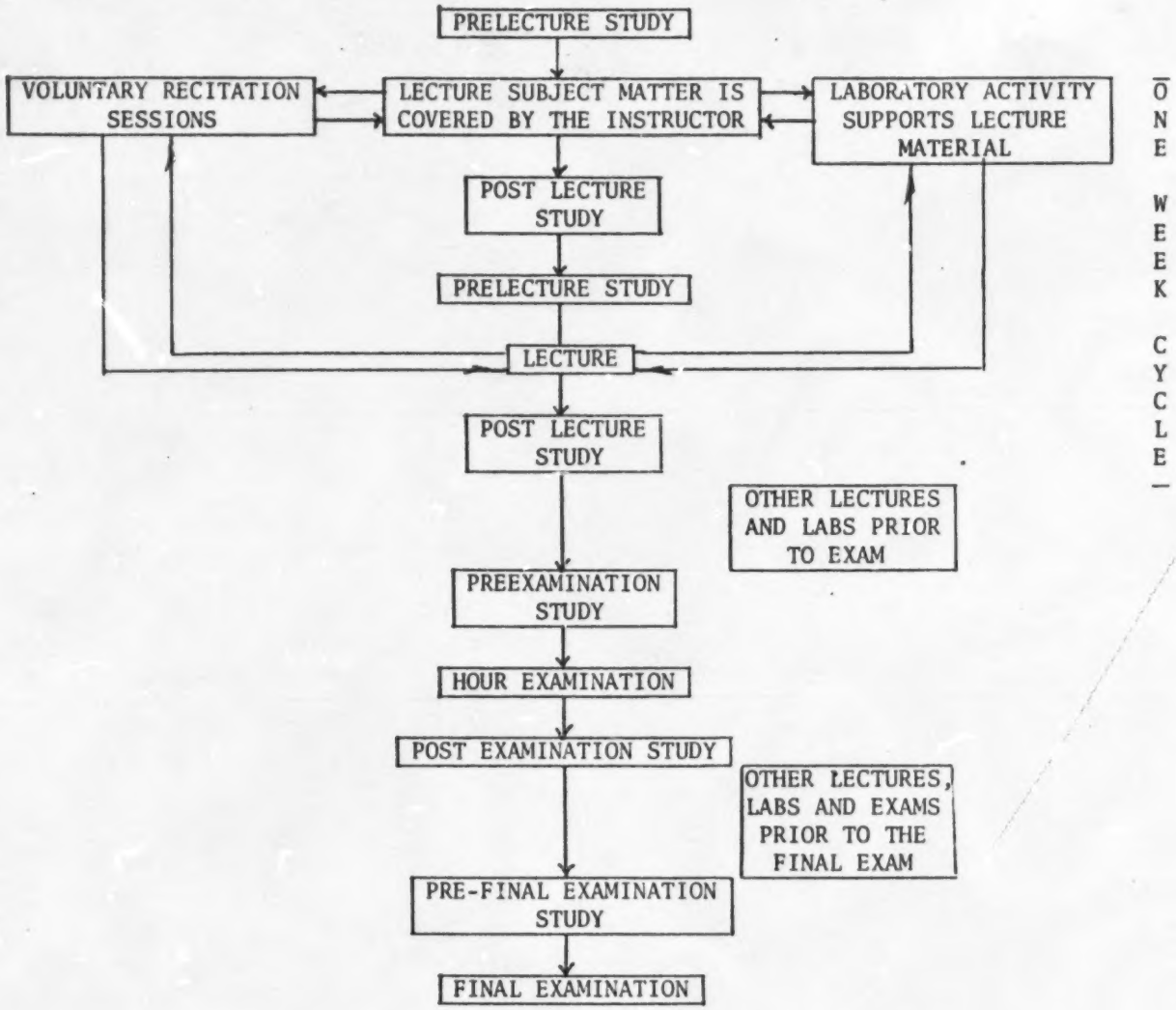

FIGURE 2. BASIC CHEMISTRY LEARNING SCHEME

In Figure 2 the arrows indicate the student's normal progress through the learning scheme.

The double (in two directions) arrows mean that the student attends a session other than a lecture and that the laboratory or recitation session functions to support that which has taken place in one or more (usually two) lectures.

APPENDIX A

COURSE OUTLINE

MAINE MARITIME ACADEMY

CH-1 GENERAL CHEMISTRY

INSTRUCTOR: PROF. SCHLENKER COURSE OUTLINE SPRING SEMESTER 1979

MATERIALS

1. Brown, T. L., and LeMay, H. E. Chemistry: The Central Science. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1977.
2. Hill, J. C. Student's Guide to Brown and LeMay Chemistry: The Central Science. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1977.
3. Nelson, J. H., and Kemp, K. C. Laboratory Experiments for Brown and LeMay Chemistry: The Central Science. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1977.

COURSE COVERAGE

SEMESTER WEEK	DATES	TEXT CHAPTER	LABORATORY NUMBER
1	– 2 Jan.	1	1
2	– 8 Jan.	2	2
3	–15 Jan.	3	3
4	–22 Jan.	5	4
5 Lecture Exam 1	–29 Jan.	6	5
6	– 5 Feb.	7	6
7	–12 Feb.	8	Lab Exam
8	–19 Feb.	9	7
9 Lecture Exam 2	–26 Feb.	11	11
10	–12 Mar.	12	13
11	–19 Mar.	13	14
12	–26 Mar.	14	16
13	– 2 Apr.	16	17
14 Lecture Exam 3	–10 Apr.,	19	Lab Exam

COURSE GRADING

Lecture Exams	100 points each	300
Final Exam		200
Lab Exams	60 points each	120
Each Lab	15 points each	180
	Total Course Points	800

FINAL GRADES:

A	-	720-800 points
B	-	640-719 points
C	-	560-639 points
D	-	480-560 points
F	-	Less than 479 points

EXAMINATION TIMES

1. Lecture Examinations 1 & 2: Will be held on Monday evening of the week indicated above. They will take place at 7:00 p. m. in Dismukes Hall.
2. Lecture Examination 3: Will be held on Thursday evening of the week indicated above. The time and place will be the same as that of Examinations 1 & 2.
3. Laboratory Examinations 1 & 2: Will be held during the normal laboratory sessions on the weeks indicated.
4. Final Examination: Will be held during the regular finals week.

ATTENDANCE: In order to receive any credit for a given laboratory session the student must be present for that session.

MAINE MARITIME ACADEMY

CH-1 GENERAL CHEMISTRY

LABORATORY INSTRUCTIONS

INSTRUCTORS: DR. BARLOW/DOROTHY SMALL SPRING 1979

MATERIALS

Nelson, J. H., and Kemp, K. C. Laboratory Experiments for Brown and LeMay Chemistry: The Central Science. Englewood Cliffs, New Jersey: Prentice Hall, Inc. 1977.

PROCEDURES

1. Read and thoroughly study the lab experiment for the week prior to coming to the lab. Lab numbers and dates can be found on your course outline sheet.

2. Choose a lab station. There are eight stations and sixteen students. You will work with a partner and the partner you have for the first lab will remain your partner throughout the semester.

3. Conduct the lab activity for the week.

4. Complete and hand in the lab report sheet for the experiment prior to leaving the lab. These sheets are found at the back of the respective lab activities. You will be graded upon the answers you provide on these sheets. Credit will not be given for a lab unless the lab report sheets are turned in prior to your leaving the lab.

LABORATORY GRADING

		TOTAL
Each laboratory ----------	15 points ------	180
Laboratory examinations -------	60 points ------	120
	Total	300

SAFETY

The following safety precautions are to be followed by all students whenever they are in the chemistry laboratory:

1. *APRONS WILL BE WORN AT ALL TIMES.*
2. *SAFETY GOGGLES OR GLASSES WILL BE WORN AT ALL TIMES.*
3. *ALL CHEMICALS WILL BE ASSUMED TO BE DANGEROUS REGARDLESS OF THEIR COLORS OR THE LABELS ON THEIR CONTAINERS.*
4. *THE HOOD WILL BE USED WHENEVER THE EXPERIMENT INSTRUCTIONS SPECIFY.*
5. *AT ALL TIMES, STUDENTS WILL FOLLOW THE SAFETY AND WORK INSTRUCTIONS LISTED ON PAGES 3 - 5 IN THE LABORATORY MANUAL (THESE SHOULD BE READ BEFORE CONDUCTING THE FIRST LABORATORY EXPERIMENT AND REPEATEDLY THEREAFTER).*